

We claim:

- 1 1. A method comprising:
2 providing a first communications service on an optical ring of a first guaranteed
3 bandwidth; and
4 providing a second communications service on the optical ring, the second
5 communications service having a maximum bandwidth, a second level
6 bandwidth, and a guaranteed minimum bandwidth.
- 1 2. The method of claim 1 wherein the first communications service is
2 telecommunications.
- 1 3. The method of claim 1 wherein the first communications service is data
2 communications.
- 1 4. The method of claim 1 wherein the second communications service is data
2 communications.
- 1 5. A machine-readable medium that provides instructions, which when executed by a
2 set of processors, cause said set of processors to perform operations comprising:
3 provisioning a hybrid variable rate pipe on a span of an optical ring; and
4 transmitting a set of traffic in the hybrid variable rate pipe.
- 1 6. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe
2 transmits the set of traffic at multiple transfer rates.
- 1 7. The machine-readable medium of claim 5 wherein the set of traffic is switched
2 through a packet mesh.

1 8. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe
2 comprises:

3 a non-BLSR protected layer 2/3 channel;
4 a segment of the working channel; and
5 at least a segment of the protection channel.

1 9. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe is
2 allocated from a contiguous set of physical channels.

1 10. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe is
2 allocated from a non-contiguous set of physical channels.

1 11. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe is
2 allocated from a non-contiguous set of physical channels and the set of traffic is
3 fractionally concatenated.

1 12. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe has
2 a first bandwidth on the span of the optical ring and a second hybrid variable rate pipe has
3 a second bandwidth on a second span of the optical ring.

1 13. The machine-readable medium of claim 5 wherein the hybrid variable rate pipe
2 comprises a non-BLSR protected layer 2/3 channel on the span, working pipe on the span,
3 and a protecting pipe on the span, the protecting pipe to protect a second working pipe on a
4 second span of the optical ring.

1 14. A machine-readable medium that provides instructions, which when executed by a
2 set of processors, cause said set of processors to perform operations comprising:
3 transmitting a first set of traffic at a first rate on a first span of an optical ring;

4 transmitting a second set of traffic at the first rate on a second span of the optical
5 ring;
6 reducing transmission of the first set of traffic to a second rate while there is a
7 failure on the second span;
8 switching the second set of traffic to the first span; and
9 transmitting the second set of traffic at a third rate while there is a failure on the
10 second span.

1 15. The machine-readable medium of claim 14 wherein the first and second set of
2 traffic are transmitted in a non-BLSR protected layer 2/3 channel, a segment of a working
3 channel, and at least a segment of a protection channel.

1 16. The machine-readable medium of claim 14 wherein switching the second set of
2 traffic is performed with BLSR automatic protection switching.

1 17. The machine-readable medium of claim 14 wherein the first set of traffic is
2 transmitted in a contiguous set of physical channels.

1 18. The machine-readable medium of claim 14 wherein the first set of traffic is
2 transmitted in a non-contiguous set of physical channels.

1 19. The machine-readable medium of claim 14 wherein the first set of traffic is
2 transmitted in a non-contiguous set of physical channels and the first set of traffic is
3 fractionally concatenated.

1 20. A machine-readable medium that provides instructions, which when executed by a
2 set of processors, cause said set of processors to perform operations comprising:
3 inhibiting automatic protection switching on a first channel over an optical ring;
4 provisioning a working channel over the optical ring;

5 provisioning a protecting channel over the optical ring;
6 transmitting a set of traffic in the first channel, a part of the working channel on a
7 first span, and at least a part of the protecting channel on the first span.

1 21. The machine-readable medium of claim 20 wherein the set of traffic includes layer
2 2/3 traffic to be switched through a packet mesh.

1 22. The machine-readable medium of claim 20 wherein the first channel is a
2 contiguous set of physical channels.

1 23. The machine-readable medium of claim 20 wherein the first channel is a set of non-
2 contiguous physical channels and the set of traffic is fragmentally concatenated.

1 24. The machine-readable medium of claim 20 wherein the part of the working channel
2 and the part of the protecting channel are a contiguous set of physical channels.

1 25. The machine-readable medium of claim 20 wherein the part of the working channel
2 and the part of the protecting channel are a set of non-contiguous physical channels and the
3 set of traffic is fragmentally concatenated.

1 26. The machine-readable medium of claim 20 wherein the part of the protecting
2 channel on the first span protects a second working channel on a second span.

1 27. The machine-readable medium of claim 20 further comprising a part of a second
2 working channel on a second span and a part of a second protecting channel on the second
3 span, the part of the second working channel and the part of the second protecting channel
4 having a bandwidth different than the part of the working channel and the part of the
5 protecting channel.

1 28. A network element comprising:
2 a time division multiplexed (TDM) processing circuitry to process a set of TDM
3 traffic; and
4 a control card coupled to the TDM processing circuitry to provision and to manage
5 a hybrid variable rate pipe, the hybrid variable rate pipe to carry the set of
6 TDM traffic.

1 29. The network element of claim 28 wherein the control card to provision the hybrid
2 variable rate pipe comprises masking BLSR protection from a subpipe of the hybrid
3 variable rate pipe.

1 30. The network element of claim 28 wherein the control card to manage the hybrid
2 variable rate pipe comprises:
3 reprogramming the TDM processing circuitry with a first set of concatenations for
4 a first and second subpipe of the hybrid variable rate pipe while a failure
5 does not exist; and
6 reprogramming the TDM processing circuitry with a second set of concatenations
7 for the first and second subpipe of the hybrid variable rate pipe while a
8 failure exists.

1 31. The network element of claim 28 wherein the hybrid variable rate pipe comprises a
2 non-BLSR protected layer 2/3 channel and a variable rate pipe allocated from a working
3 channel and a protecting channel.

1 32. The network element of claim 28 wherein the hybrid variable rate pipe comprises a
2 contiguous set of physical channels.

1 33. The network element of claim 28 wherein the hybrid variable rate pipe comprises a
2 non-contiguous set of physical channels.

1 34. The network element of claim 28 further comprising:
2 an ingress layer 2/3 processing circuitry coupled to the TDM processing circuitry,
3 the ingress layer 2/3 processing circuitry to process a first set of layer 2/3
4 traffic extracted from the set of TDM traffic by the TDM processing
5 circuitry; and
6 an egress layer 2/3 processing circuitry coupled to the TDM processing circuitry,
7 the egress layer 2/3 processing circuitry to process a second set of layer 2/3
8 traffic and transmit the second set of layer 2/3 traffic to the TDM processing
9 circuitry.

1 35. An apparatus comprising:
2 a time division multiplexed (TDM) processing circuitry to process a set of TDM
3 traffic and extract a first set of layer 2/3 traffic from the set of TDM traffic,
4 the first set of layer 2/3 traffic having been received on a set of physical
5 channels;
6 an ingress layer 2/3 processing circuitry coupled to the TDM processing circuitry,
7 the ingress layer 2/3 processing circuitry to process the first set of layer 2/3
8 traffic; and
9 an egress layer 2/3 processing circuitry coupled to the TDM processing circuitry,
10 the egress layer 2/3 processing circuitry to process a second set of layer 2/3
11 traffic and transmit the second set of layer 2/3 traffic to the TDM processing
12 circuitry; and
13 a control card coupled to the TDM processing circuitry to inhibit automatic
14 protection switching on a first subset of the set of physical channels and to
15 protect a second subset of the set of physical channels with automatic
16 protection switching.

1 36. The apparatus of claim 35 wherein the set of physical channels are contiguous.

1 37. The apparatus of claim 35 wherein the set of physical channels are non-contiguous.

1 38. The apparatus of claim 35 wherein the set of physical channels are non-contiguous
2 and the first set of layer 2/3 traffic is fragmentally concatenated.

1 39. The apparatus of claim 35 further comprising:

2 a second egress layer 2/3 processing circuitry coupled to the ingress layer 2/3
3 processing circuitry, the second egress layer 2/3 processing circuitry to
4 receive the first set of layer 2/3 traffic and transmit the first set of layer 2/3
5 traffic;

6 a second TDM processing circuitry coupled to the control card and the second
7 egress layer 2/3 processing circuitry, the second TDM processing circuitry
8 to receive the first set of layer 2/3 traffic from the second egress layer 2/3
9 traffic and to transmit a second set of TDM traffic in a second set of
10 physical channels, the second set of TDM traffic having the first set of layer
11 2/3 traffic; and

12 the control card coupled to the second TDM processing circuitry, the control card
13 to detect a failure on a path corresponding to the second TDM processing
14 circuitry and switch the first set of layer 2/3 traffic traveling in a second
15 subset and third subset of the second set of physical channels to the third
16 subset of the first set of physical channels, the second set of physical
17 channels having at least three subsets of physical channels.

1 40. A computer implemented method comprising:

2 provisioning a hybrid variable rate pipe on a span of an optical ring; and
3 transmitting a set of traffic in the hybrid variable rate pipe.

1 41. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe transmits the set of traffic at multiple transfer rates.

1 42. The computer implemented method of claim 40 wherein the set of traffic is
2 switched through a packet mesh.

1 43. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe comprises:

- 3 a non-BLSR protected layer 2/3 channel;
- 4 a segment of the working channel; and
- 5 at least a segment of the protection channel.

1 44. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe is allocated from a contiguous set of physical channels.

1 45. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe is allocated from a non-contiguous set of physical channels.

1 46. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe is allocated from a non-contiguous set of physical channels and the set of traffic is
3 fractionally concatenated.

1 47. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe has a first bandwidth on the span of the optical ring and a second hybrid variable rate
3 pipe has a second bandwidth on a second span of the optical ring.

1 48. The computer implemented method of claim 40 wherein the hybrid variable rate
2 pipe comprises a non-BLSR protected layer 2/3 channel on the span, working pipe on the

3 span, and a protecting pipe on the span, the protecting pipe to protect a second working
4 pipe on a second span of the optical ring.

1 49. A computer implemented method comprising:
2 transmitting a first set of traffic at a first rate on a first span of an optical ring;
3 transmitting a second set of traffic at the first rate on a second span of the optical
4 ring;
5 reducing transmission of the first set of traffic to a second rate while there is a
6 failure on the second span;
7 switching the second set of traffic to the first span; and
8 transmitting the second set of traffic at a third rate while there is a failure on the
9 second span.

1 50. The computer implemented method of claim 49 wherein the first and second set of
2 traffic are transmitted in a non-BLSR protected layer 2/3 channel, a segment of a working
3 channel, and at least a segment of a protection channel.

1 51. The computer implemented method of claim 49 wherein switching the second set
2 of traffic is performed with BLSR automatic protection switching.

1 52. The computer implemented method of claim 49 wherein the first set of traffic is
2 transmitted in a contiguous set of physical channels.

1 53. The computer implemented method of claim 49 wherein the first set of traffic is
2 transmitted in a non-contiguous set of physical channels.

1 54. The computer implemented method of claim 49 wherein the first set of traffic is
2 transmitted in a non-contiguous set of physical channels and the first set of traffic is
3 fractionally concatenated.